

TRAFFIC SPEED REPORT NO. 76
TRUCK WEIGHT-SPEED STUDY

JANUARY, 1963

NO. 7

by
D.E. DILLARD

Joint
Highway
Research
Project

PURDUE UNIVERSITY
LAFAYETTE INDIANA

Progress Report

TRAFFIC SPEED REPORT NO. 76
TRUCK WEIGHT-SPEED STUDY

TO: K. B. Woods, Director January 30, 1963
Joint Highway Research Project

FROM: H. L. Michael, Associate Director File: 8-3-4
Joint Highway Research Project Project: C-36-10D

Attached is Traffic Speed Report No. 76 which is the 1962 Truck Weight-Speed Study. This annual study which is performed in cooperation with the State Highway Planning Survey Unit of the Indiana State Highway Commission was conducted by Mr. David E. Dillard of our staff.

A summary of the results of similar studies made in previous years and these data for 1962 indicate that the trend of average speed and weight of trucks have increased gradually during the past decade. The 85th percentile speed of these trucks, however, has slightly decreased since a high was reached in 1959-60. There is also an indication of some correlation between vehicle speed and vehicle weight.

Copies of this report will be distributed to the Highway Planning Unit, the Bureau of Public Roads and the Indiana State Police. The report is submitted for the record and for such release.

Respectfully submitted,

Harold L. Michael
Harold L. Michael, Secretary

HLM:kmc

Attachment

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by

David E. Dillard
Graduate Assistant

Joint Highway Research Project
File No: 8-3-4
Project No: C-36-10D

Performed in Cooperation

with

The State Highway Planning Survey

Indiana State Highway Commission

August 21, 22, 24, 30
September 5, 6, 7, 12, 17
1962

Purdue University
Lafayette, Indiana

January 30, 1963

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TRUCK WEIGHT - SPEED STUDY

Introduction

The eighteenth annual truck weight-speed study was conducted during the months of August and September 1962 by the Joint Highway Research Project of Purdue University in cooperation with the Highway Planning Survey Unit of the Indiana State Highway Commission. The Highway Planning Survey Unit makes annual studies of truck weights, size, material hauled, etc. at twenty permanent truck-weight stations located throughout the state. The truck weight-speed study matches the weight of a truck, obtained by the Planning Unit with portable loadometer scales, and the observed speed of the same vehicle as recorded at a nearby speed station. This provides the basis for a correlation of truck speeds with truck weights.

Data from nine truck weight stations were used for the truck weight-speed study. These stations are shown on Figure 1 and are further described as follows:

<u>Station</u>	<u>Highway</u>	<u>Location</u>	<u>Date of obs.</u>	<u>No. of Lanes</u>
58B	U.S.31	0.2 mi S of Southport Road	Aug. 21	4
75	U.S.41	0.2 mi S of U.S.41 Bus.	Aug. 22	4
81	U.S.150	0.5 mi E of S.R.56	Aug. 24	2
45B	S.R.67	1.0 mi SW of Muncie	Aug. 30	2
5	U.S.30	1.3 mi E of Bourbon	Sept. 5	2
4	U.S.31	0.2 mi S of U.S.6	Sept. 6	2
2	U.S.20	0.3 mi W of S.R.2	Sept. 7	4
14	U.S.41	0.5 mi S of S.R.2	Sept. 12	4
42	U.S.52	at Jct. of S.R.38	Sept. 17	4

The speed observations were made on level, tangent sections of highway between one and three miles from the weight station. In all cases, sufficient distance was allowed for the trucks to regain normal cruising speed while minimizing opportunities for the vehicles to turn off the highway.

The speed data were collected by the author and Mr. John Whitworth. The analysis was performed by the author with the aid of members of the Traffic Engineering Laboratory staff.

Equipment and Field Procedure

The speed observations were made with an Electromatic Radar Speed Meter reading directly in miles per hour. The radar was checked for accuracy prior to field use. While in the field, accuracy of radar readings was verified by frequent checks with a 60-mile per hour tuning fork. The radar unit was placed upon a box approximately four feet from the edge of the pavement and was oriented at a small angle with the direction of traffic flow. Complete concealment of the equipment is not practical on modern highways having adequate shoulder width. To lessen the effect of driver observation of a speed meter, the meter set up was covered by a large wooden packing box with a color that blended with the surrounding landscape. A 100 foot extension cord permitted the observer and indicator unit to be out-of-sight. There was no apparent change in speed under these conditions as traffic approached the speed station.

For use in this study only normal highway truck speeds were desired. Therefore, observations were made only on "free-flowing" trucks - that is, trucks not hampered by other traffic or by a change in speed resulting from a turn or stop. This limitation resulted in obtaining a small amount of data on low capacity highways.

The speed stations were operated during the same hours as the truck weight station. During the four-hour period 8 a.m. to 12 noon, trucks moving in one direction along the highway were observed. During the afternoon, 12 noon to 4 p.m., observations were made on trucks traveling in the opposite direction.

Procedure of Analysis

For this analysis, all trucks were grouped into the general categories of single-unit or multi-unit (with trailer) vehicles.

In addition, the single-unit grouping was subdivided by weight into those having a gross weight of 5,000 pounds or more, and those weighing less than 5,000 pounds. This weight classification corresponds to the existing Indiana speed limits for trucks: 65 miles per hour for "light" (less than 5,000 pounds) trucks; 55 miles per hour for "heavy" (5,000 pounds or more) trucks on four-lane highways with a median of 20 feet or more; and 50 miles per hour for heavy trucks on other highways.

Table I provides the speed and weight data of single-unit trucks while Table II presents similar data for multi-unit trucks. In these two tables, the data are also summarized by type of highway (2 or 4 lane).

Summary of Results

From Tables I and II the following observations are made:

Single-unit trucks less than 5,000 pounds gross weight -

	2-lane hwys.	4-lane hwys.	all hwys.
No. of vehicles observed	39	50	89
Average speed (mph)	48.9	51.9	50.7
Average weight (lbs.)	4,600	4,300	4,400

Single-unit trucks over 5,000 pounds gross weight -

No. of vehicles observed	215	306	521
Average speed (mph)	47.3	49.1	48.3
Average weight (lbs.)	13,300	12,960	13,100

Multiple-units (truck-trailer) -

No. of vehicles observed	441	638	1079
Average speed (mph)	47.3	50.6	49.2
Average weight (lbs.)	43,200	42,300	42,700

Table III reveals that 3.4% of the light trucks exceeded the legal 65 mph speed limits and only 1.1% exceeded an "enforceable" speed limit of 70 mph. On two-lane highways, slightly over 26% of the heavy trucks exceeded the legal limit of 50 mph. The percentage exceeding an enforceable speed limit (55 mph) was 11.2% for heavy single-units and 6.7% for multi-units. On four-lane highways, 18.2% of the heavy single-units and 23.4% of the multi-units exceeded the legal 55 mph speed limit. On this type of highway, only 5.9% of the heavy trucks and 3.6% of the truck-trailer combinations traveled faster than a 60 mph "enforceable" speed.

A comparison of average speeds and weights for the last fourteen years is presented in Table IV. The average speed of single unit trucks has shown a tendency to increase since 1949. During the last few years, the average weights have also apparently increased from less than 9,000 lbs. to above 10,000 lbs. The average speed and weight of multi-unit trucks have also increased during this period of time. Truck-trailer weights appear to have a fairly constant upward trend.

The cumulative frequency distribution curves (Figures 2, 3, and 4) indicate that multi-unit trucks travel with less speed variation between trucks than the single-unit vehicles. This is disclosed by the steepness of the central portion of the frequency curve and the narrower speed differential between the 15th and 85th percentile. The group exhibiting the greatest variability in speeds is the light single-unit trucks.

A plot of average trucks speed versus truck weights as obtained in the 1962 study produced the diagrams of Figures 5 and 6. The points

plotted are average speeds for a weight classification while the numbers represent the number of vehicles observed in that classification. The lines were fitted to the plotted data using the observed fit technique. The slope of the lines suggests the possible relationship between truck weight and truck speed.

Figures 7 and 8 are graphical portraits of the trend in 85th percentile truck speed 1953-1962 for two-lane and four-lane highways, respectively. The trend curves were fitted to the data by the observed fit technique so as to give smooth curves. Although average speeds have been increasing rather steadily for all truck types (see Table IV), the 85th percentile speed for each truck type has decreased since 1959-1960.

The data reported here are submitted primarily for the record and are not completely analyzed. The data will be submitted to the Bureau of Public Roads for use by them in their continuing speed-weight studies in the United States and the data will be added to the speed trend and speed-weight trend data of the Joint Highway Research Project.

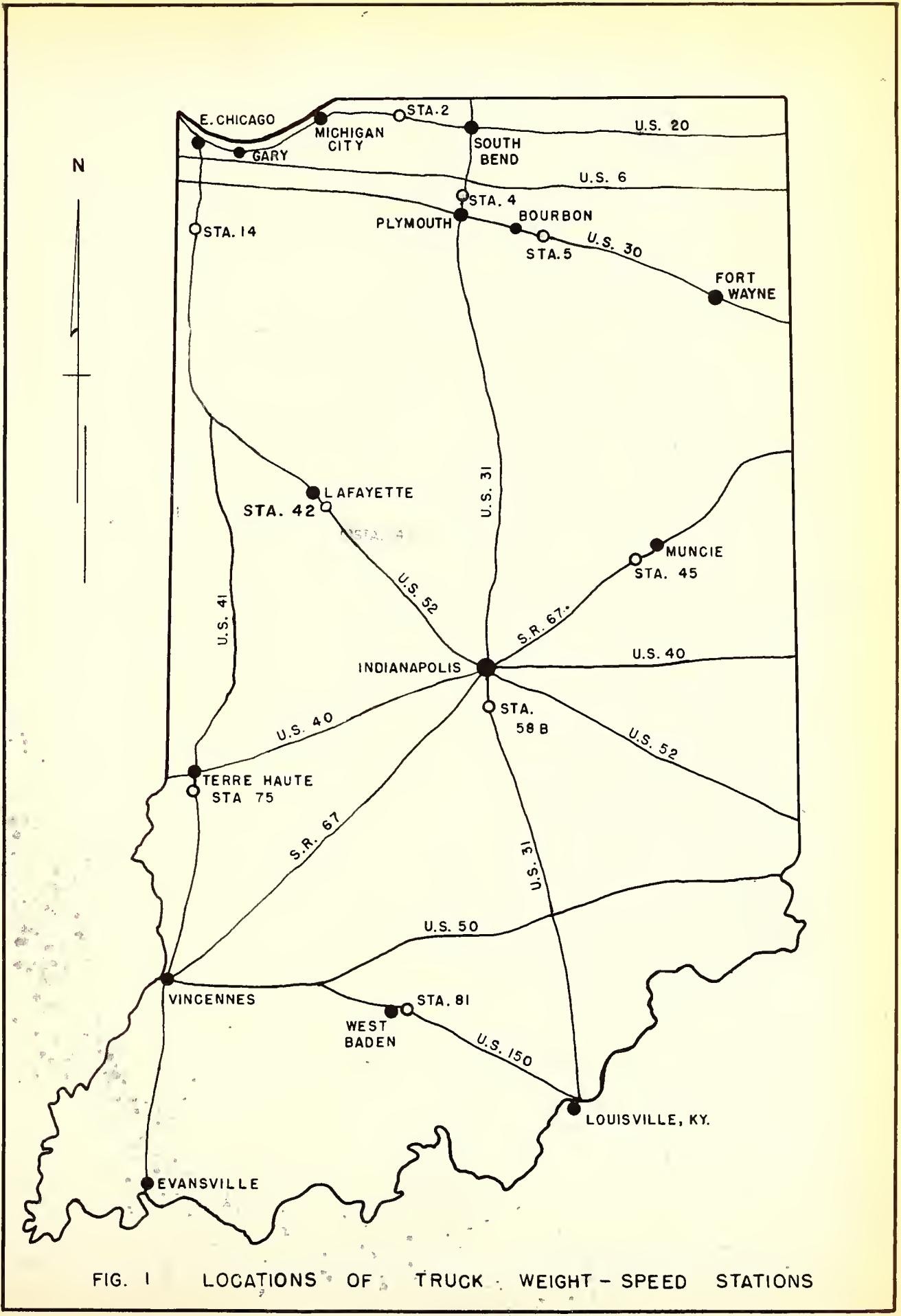


FIG. 1 LOCATIONS OF TRUCK WEIGHT - SPEED STATIONS

PERCENTILE

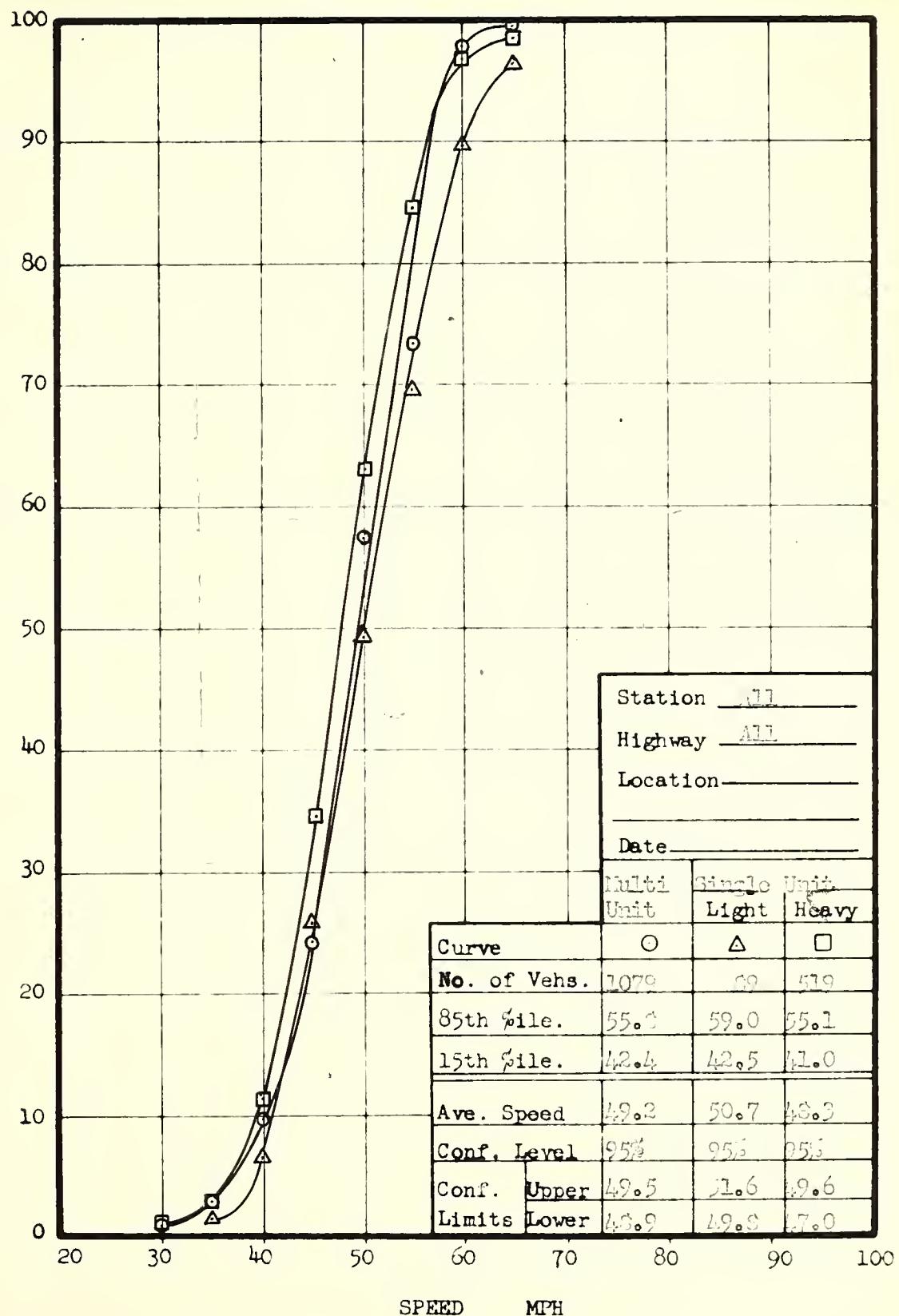


FIGURE 2. CUMULATIVE FREQUENCY CURVES FOR ALL HIGHWAYS

PERCENTILE

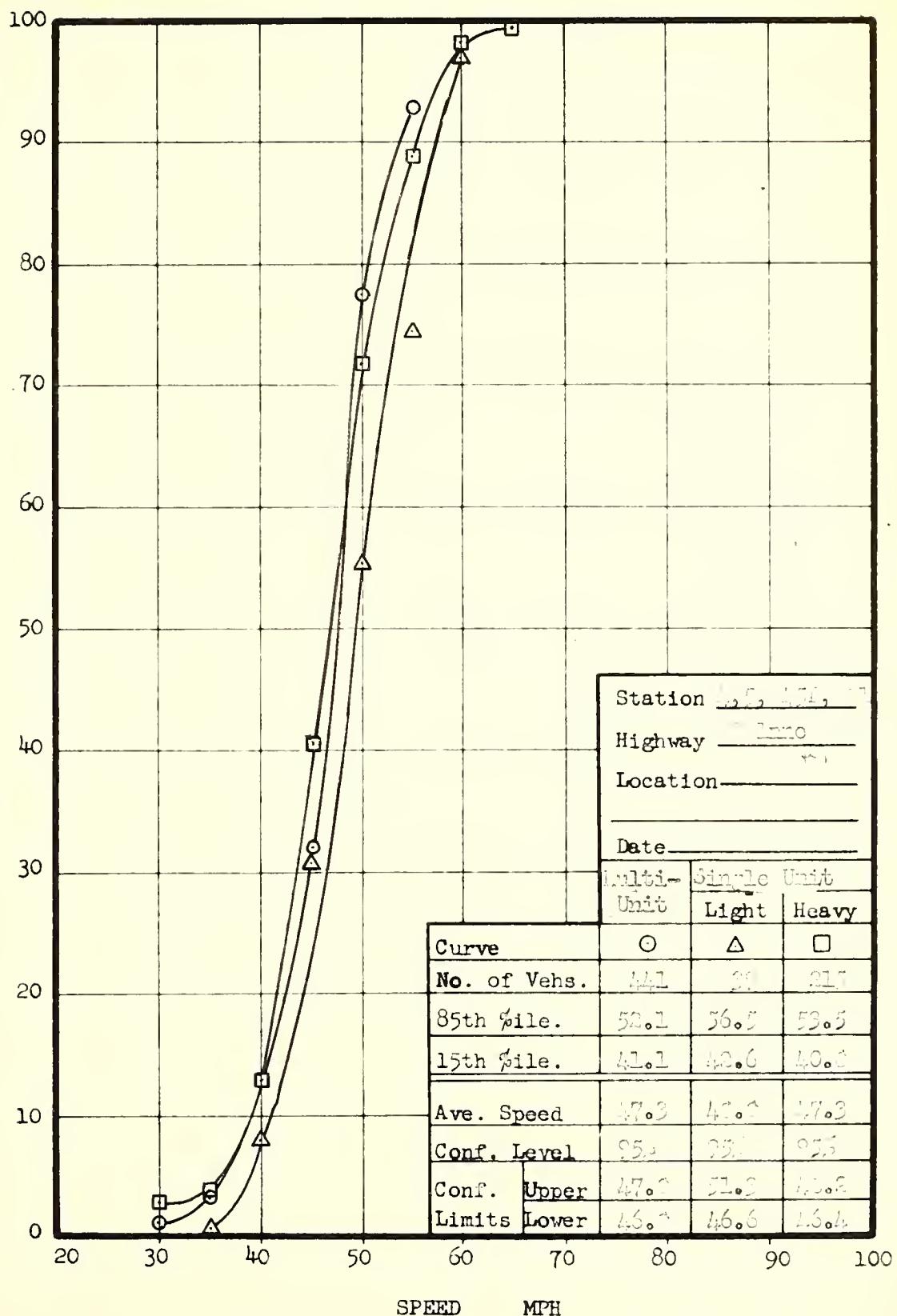


FIGURE 3. CUMULATIVE FREQUENCY CURVES FOR TWO-LANE HIGHWAYS

PERCENTILE

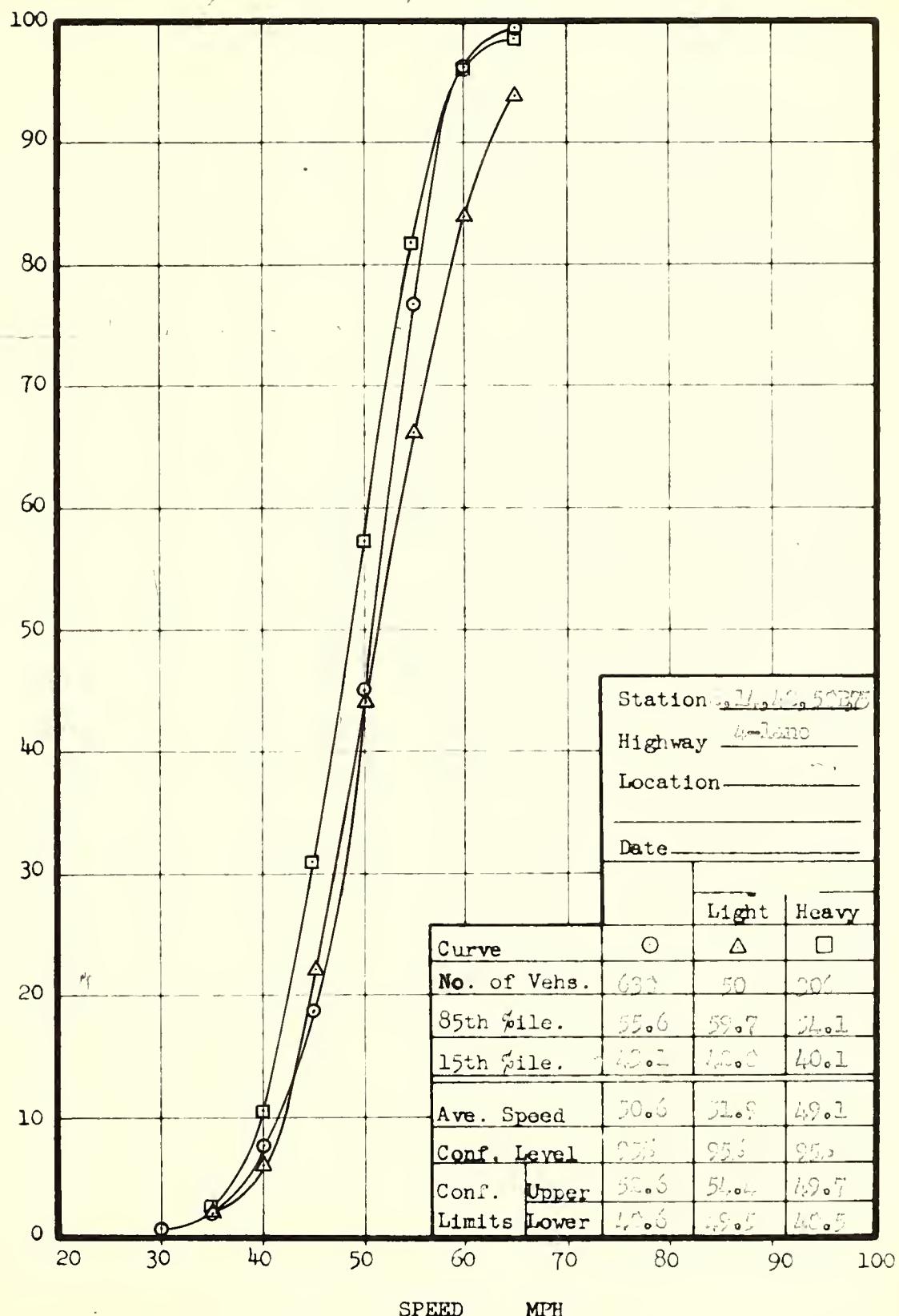


FIGURE 4. CUMULATIVE FREQUENCY CURVES FOR FOUR-LANE HIGHWAYS

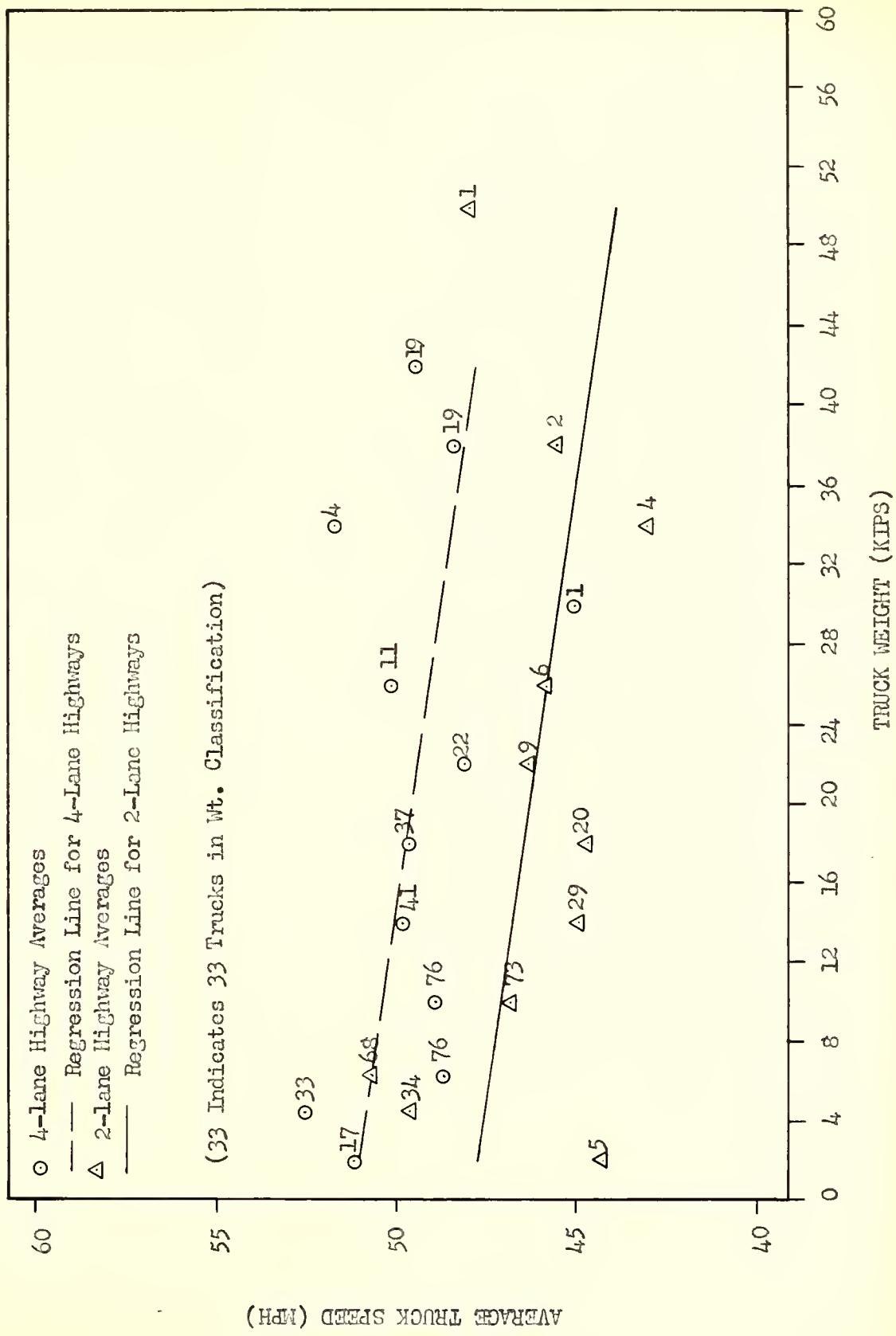


FIGURE 5. AVERAGE TRUCK SPEED FOR TRUCK WEIGHT CLASSIFICATION (SINGLE-UNITS)

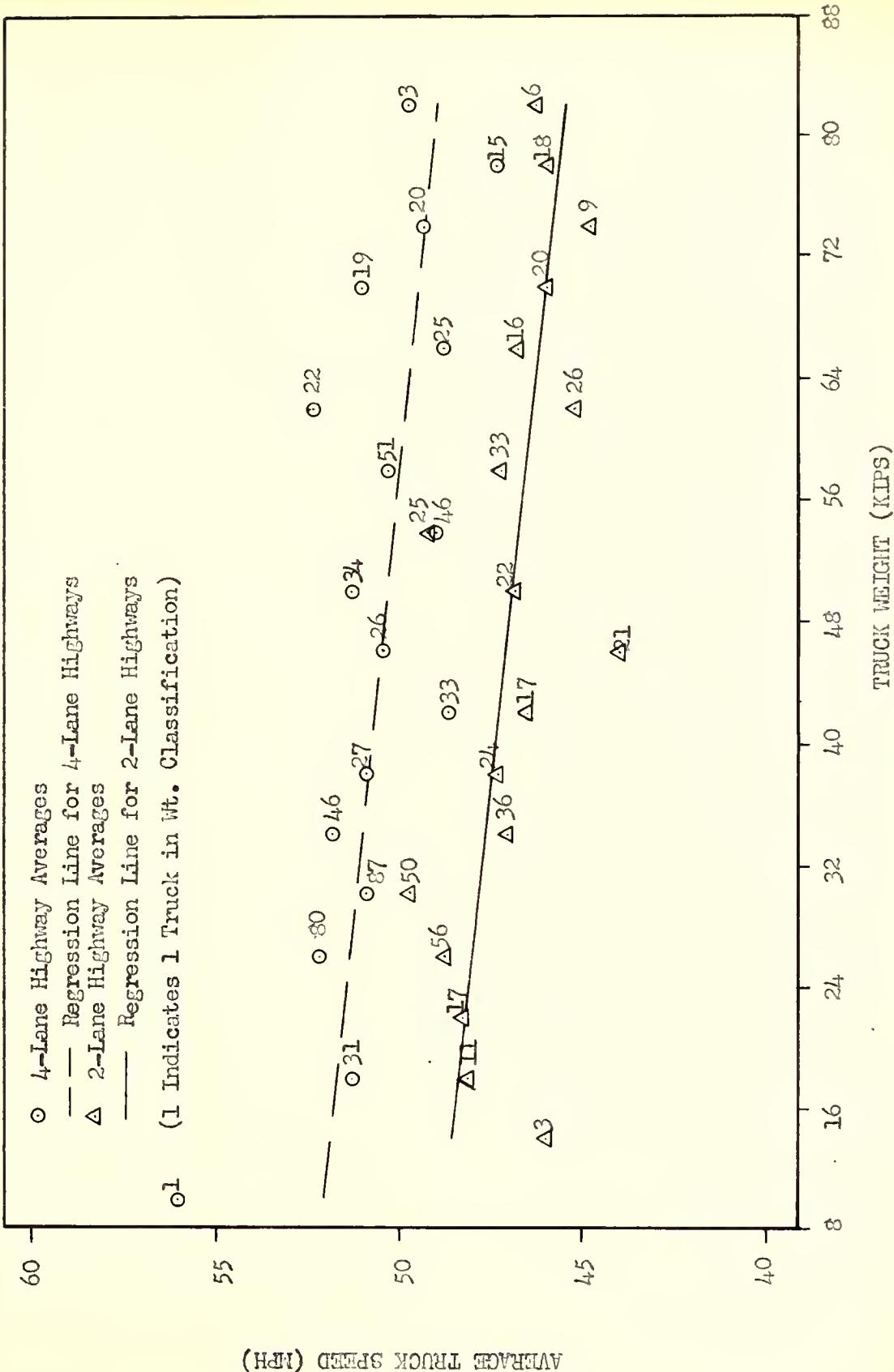


FIGURE 6. AVERAGE TRUCK SPEED FOR TRUCK WEIGHT CLASSIFICATION (MULTI-UNITS)

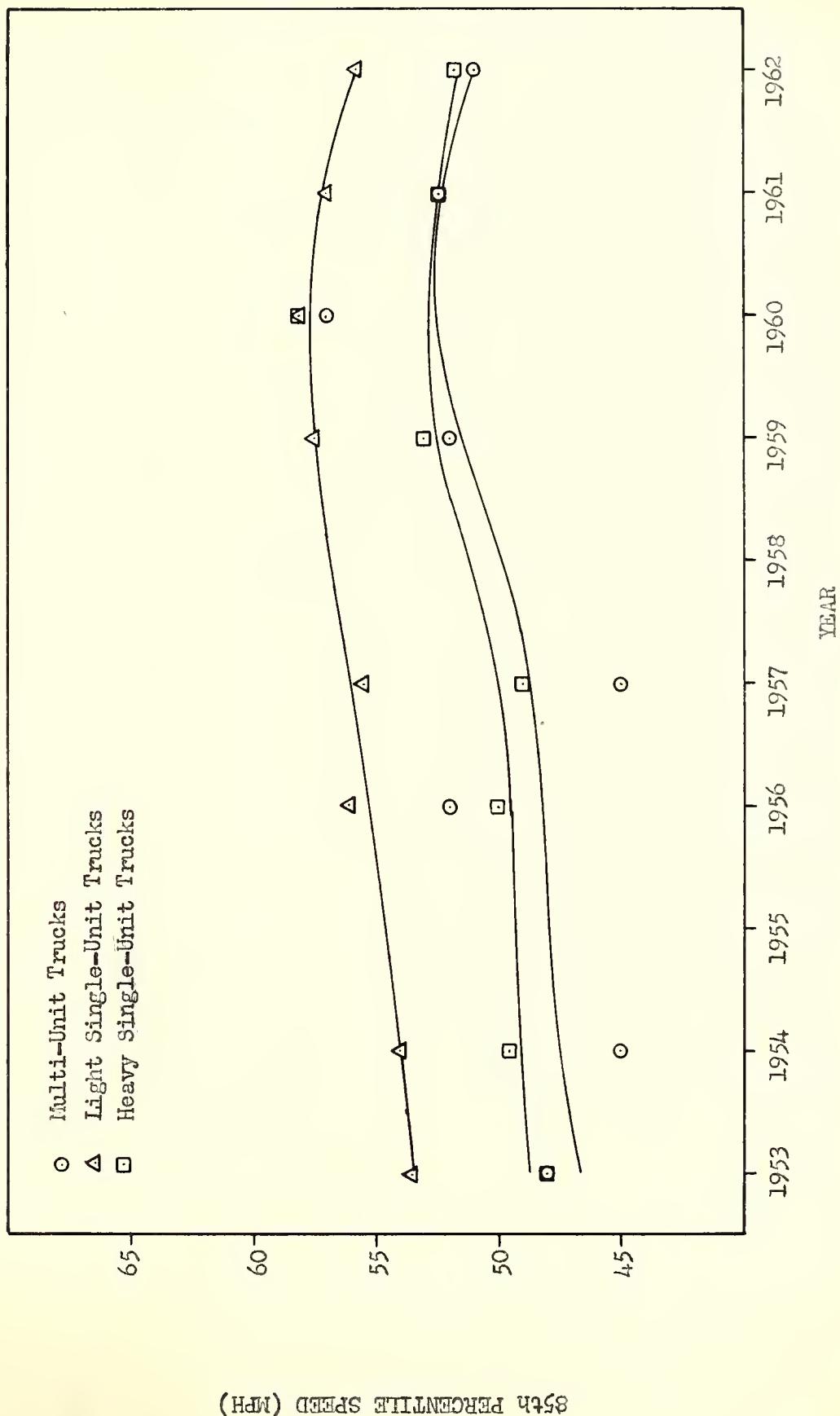


FIGURE 7. TRENDS IN THE 85th PERCENTILE TRUCK SPEED ON TWO-LANE HIGHWAY (1953-1962)

TABLE I SINGLE-UNIT TRUCK SPEEDS (KPH)

TABLE II MULTI-UNIT THERMOPOLYMER (iPh)

TABLE III

PERCENT OF TRUCKS VIOLATING SPEED LIMITS

Station	Trucks Weighing Under 5000 lbs.			Trucks Weighing Over 5000 lbs.			Multiple Units		
	No. Noted	% Exceed 65 MPH	% Exceed 70 MPH	No. Noted	% Exceed 50 MPH	% Exceed 55 MPH	No. Noted	% Exceed 50 MPH	% Exceed 55 MPH
45-B	15	0	0	52	31.5	7.2	110	46.4	16.4
5	3	0	0	31	48.4	22.6	198	21.2	4.5
4	7	0	0	71	29.6	4.9	102	18.1	2.9
81	14	0	0	61	27.9	6.6	31	3.2	0
Total	39	0	0	215	28.4	11.2	441	25.5	6.7
<i>Two-Lane Highways</i>									
2	2	0	0	64	10.9	3.1	137	12.5	0
14	7	0	0	50	28.0	2.0	200	26.0	4.5
42	13	15.4	0	77	28.6	10.4	140	22.1	7.1
58-B	18	0	0	95	10.5	1.1	148	11.5	2.0
75	10	10.0	10.0	20	5.0	0	13	15.4	7.6
Total	50	6.0	2.0	306	18.2	5.9	638	23.4	3.6
Summary	82	3.6	1.1	527	1070				

TABLE IV

TRUCK WEIGHT-SPEED DATA
COMPARISON OF DATA FROM STUDIES IN VARIOUS YEARS

Year	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962
Number of Single-Unit Trucks	578	791	1242	1482	1239	905	762	952	1028	837	481	424	938	610
Average Speed of Single-Unit Trucks, mph	42.2	42.4	43.0	43.4	43.4	43.9	45.8	45.9	47.0	46.3	46.5	45.5	49.1	48.0
Average Weight of Single-Unit Trucks, lb.	9,400	8,700	8,600	8,700	8,400	8,000	8,900	8,300	9,400	9,900	9,230	12,000	10,600	11,800
Number of Multiple-Unit Trucks	581	879	1,402	1,354	1,507	1,064	1,120	1,033	1,161	1,130	604	644	1,149	1,079
Average Speed of Multi-Unit Trucks, mph	43.2	42.7	43.5	44.1	43.1	43.6	43.5	44.4	42.5	46.1	48.6	50.3	48.6	49.2
Average Weight of Multi-Unit Trucks, lb.	32,500	36,700	35,900	35,800	37,400	36,400	37,900	37,100	39,500	40,300	39,300	42,595	42,700	

